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RADIUM

EDITED BY
CHARLES H. VIOL, Ph. D.
AND
WILLIAM H. CAMERON, M. D.

VOL. IX APRIL, 1917 No. 1

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A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES.

Edited and Published by Charles H. Viol, Ph. D., and William H. Cameron, M. D. with the assistance of collaborators working in the fields of Radiochemistry, Radioactivity and Radiumtherapy.

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VOL. IX APRIL, 1917 No. 1

RADIUM IN THE TREATMENT OF CANCER AND VARIOUS OTHER DISEASES OF THE SKIN.*

FRANK E. SIMPSON, M. D., CHICAGO.

Although some do not admit that radium acts on the skin and other tissues in a manner different from Roentgen rays, I am convinced of the error of this view. There are both theoretical reasons and strong clinical evidence for the opinion that the effects of these two agents differ.

The rays emitted by radium are of three, and according to some of four distinct kinds, known as alpha, beta, gamma and delta rays. From the Roentgen-ray tube are given off rays that are similar to but by no means identical with the gamma rays of radium. The character of the rays emitted by the Roentgen-ray tube and radium being different, one would expect that the reactions in the skin would be different. And this is what we find to be the case when critical examination is made of the results obtained with both agents.

The reactions in the skin differ in several important particulars, some of which may be briefly considered.

Both Roentgen rays and radium may produce in living tissue, first a selective and, second, an inflammatory action.

By selective action is meant a retrogressive change in the tissues that goes on without visible macroscopic inflammation. The meaning of inflammatory action which is produced by Roentgen rays or radium is self-evident.

In the case of Roentgen rays the selective action is by far the

*Jour. Am. Med. Assn., LXVII, 1508-11, Nov. 18, 1916. Read before the Section on Dermatology at the Sixty-Seventh Annual Session of the American Medical Association, Detroit, June, 1916.

more important. The depilation of the hair in ringworm of the scalp by Roentgen rays is a good example of the selective action of this agent. Here the hair is made to fall without the intervention of any visible inflammation.

All of the various methods for measuring Roentgen-ray dosage are directed toward the estimation of the so-called erythema dose. Few Roentgen-ray therapeutists are willing to push the dose, systematically and constantly, to a point at which destructive inflammation may occur. With radium the case is entirely different. While some pathologic tissues, as keloids, and vascular nevi may be made to yield to the selective action of radium, erythema is much more frequently excited with therapeutic doses of radium than with Roentgen rays, and the dose may even be pushed to the point of destructive inflammation without doing harm, if proper precautions are observed.

This is one of the most important and interesting of the differences between therapeutic Roentgen rays and radium reactions.

In a word, Roentgen rays, while a splendid "selective," are, in general, a poor "destructive" agent, when good cosmetic effects are desired, because of the well known dangers and the uncertainty of the repair of the tissues.

Radium, on the other hand, is not only a useful "selective" but also a good "destructive" agent. This destructive power is one of its important uses because of the ease of its employment and the elegance of the reparative tissue.

The destructive or caustic power of radium must be used, however, with discrimination and care when fine cosmetic effects are desired. Only by long experience can the full value of its destructive effects be utilized. Too great dosage may result in sluggish ulcerations or later on in the production of telangiectasia, atrophy, etc., which detract very much from the cosmetic appearance of the tissues of repair.

From the foregoing may be deduced some of the general principles of radium therapy.

Radium shares the field with Roentgen rays in the treatment of a number of intractable disorders of the skin. In certain diseases, radium and Roentgen rays may be regarded as alternative agents, the choice depending on the convenience of the operator. Often a combination of Roentgen rays and radium is desirable. In some diseases Roentgen rays are much more convenient and efficient than radium, while in a certain restricted and peculiar field of dermatology radium holds an absolutely unique position. Among the disorders in which radium has been found of value are the following:

1. *Cancer of the Skin.*—I have now treated over 200 cases of cancer of the skin, and failure to bring about recovery has been rare.

Failure occurs as a rule only in the very extensive cases often previously treated by other methods. In some of these cases loss of tissue is so extensive that repair is almost impossible.

In other cases there seems to be a lack of power of vital reaction on the part of the tissues, which finally may refuse to respond at all. On the whole, however, radium is one of our most satisfactory agents in the treatment of skin cancers, and certain cases will yield which have apparently resisted all the usual measures.

The general rule that operable cancers should be operated on does not apply in my judgment to the majority of cases of skin epithelioma, particularly those of the rodent ulcer type. In many of these cases

radium alone or combined with surgery is superior to surgery alone, the elegance of the cosmetic results and the relative infrequency of recurrence being among its advantages. Small epitheliomas can readily be healed with one-fourth or one-half strength applicators screened with O.1 mm. of lead by giving an exposure of from six to ten hours in the course of three or four days.

With extensive epitheliomas I frequently use 150 or more mg. of radium element contained in a half-dozen or more tubes and disposed over the surface of the epithelioma.

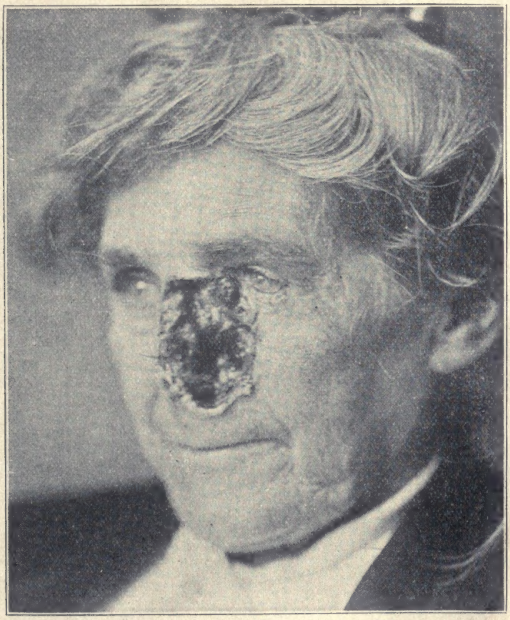

Fig. 1. Epithelioma of nose, upper lip, cheek and eyelid. Photograph taken September, 1914.

It is very convenient to have at one's command tubes containing as much as 50 or more mg. of radium element. One of these can be inserted, for instance, into the external auditory canal or deep in the cavity of the orbit if the eye has been removed. Depending on the disposition of the tubes and the screening employed, healing of every extensive epithelioma may be brought about in from three to twenty or more hours. With large quantities of radium, however, it is very important not to produce severe reactions or burns, as these are liable to be very painful and may heal very slowly.

2. *Cancer of the Mucous Membranes.* — Sometimes the result of the radium treatment of buccal, lingual and pharyngeal epithelioma is brilliant and at other times disappointing. In cancer of these structures,

metastases may occur so early in the neighboring lymph glands that while the original lesion may be healed the general progress of the disease is merely checked. Prolonged and persistent treatment of the adjacent infected glands with gamma rays will often materially retard their growth.

The method of treatment of cancer of the mucous membranes presents problems that constantly tax one's ingenuity. It is often possible to attach to the teeth one end of a piece of silver wire, the other end being inserted into a piece of pure gum rubber tubing which carries the radium applicator.

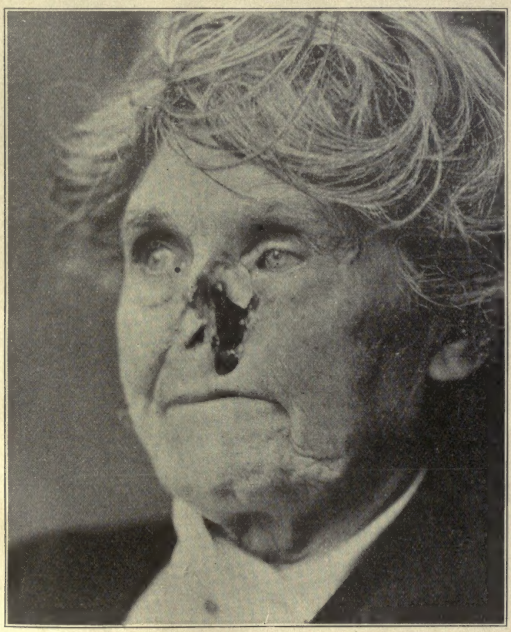

Fig. 2. Patient in Figure 1, showing recovery after sixty hours' radium treatment. Photograph taken July, 1915.

I have devised a number of simple appliances that serve more or less well the purpose of keeping the heavily screened radium in contact with the growth.

Several illustrative cases will show the method of dealing with certain of these epitheliomas:

CASE 1. *Epithelioma of posterior aspect of soft palate.*—This patient, aged 45, referred by Dr. E. H. Skinner and Dr. D. Walton Hall of Kansas City, Mo., was first seen Nov. 1, 1915. Diagnosis was clinical and microscopic. Treatment was carried out by passing 50 mg. of radium element screened with 1 mm. of silver through the anterior nares until it rested on the growth. A total exposure of fourteen hours was

given. Improvement was almost immediately manifested, although it had previously been refractory to Roentgen rays.

Three months later the growth had completely retrogressed. The good result in this case was undoubtedly contributed to by deep Roentgen rays subsequently applied by Dr. Skinner over the growth and the regional lymph glands.

CASE 2.—*Epithelioma of the buccal mucous membrane.*—Man, aged 60, referred by Dr. G. T. von Colditz, was first seen, Oct. 1, 1915. Diagnosis was clinical and microscopic. The growth was situated on the buccal mucous membrane opposite the root of the right lower bicuspid tooth. It was about 2 cm. in diameter, ulcerated and deeply infiltrated. The treatment consisted of a total of thirty hours' exposure in fractional doses with 50 mg. radium element screened with 1.5 mm. of silver.

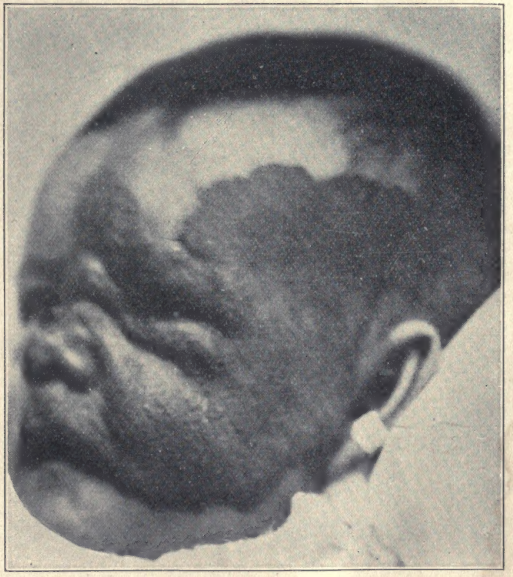

Fig. 3. Vascular, deep purplished-red nevus, markedly elevated and rapidly spreading. Patient aged 6 weeks. Photograph taken September, 1914.

December 17, the growth had nearly disappeared, but there was still to be felt some deep infiltration. The growth was then rayed with 75 mg. radium element screened with 1.5 mm. of silver for a total of twelve hours.

Feb. 21, 1916, nothing but a smooth supple scar remained.

The patient was also vigorously rayed over the regional lymph glands of the neck to prevent metastases if possible. At the present time he continues in good health.

CASE 3.—*Epithelioma (?) supervening on extensive leukoplakia.*—man, aged 54, referred by Dr. A. B. Kanavel, was first seen March 16, 1915. Diagnosis was clinical, as it was not thought advisable to remove material for a section. The patient exhibited very extensive leukoplakia of the entire left buccal mucous membrane. There was marked ulceration, especially posteriorly, and the affected mucous membrane was covered with a very foul secretion. The mouth could be opened with difficulty. The regional lymph glands of the left side of the neck were swollen to the size of hazelnuts, and were hard but not tender to the touch. Treatment consisted of "cross firing" the cheek and neck with 150 mg. radium element contained in various applicators and screened with 2 mm. of silver for a total of sixty hours. July 2, 1915, the mu-

Fig. 4. Patient in Figure 3, at age of 1 1-2 years, showing results of radium treatment. Photograph taken March, 1916. Not retouched.

cous membrane of the cheek was entirely well and showed a smooth and supple scar, while the glands of the neck had entirely disappeared. When seen nine months later (April, 1916) the patient was in remarkably good health and had gained 30 pounds in weight.

This case is illustrative of six similar cases treated in the same manner and resulting in recovery.

3. *Vascular Nevi ("Birth Marks").*—The treatment of vascular nevi is an art in itself. In certain types of very extensive nevi the results from radium treatment are far in advance of those obtained by other methods. Radium has the advantage of being painless, while the cosmetic appearance is often very excellent.

There is a certain place, however, for other well known methods, and in individual cases radium may be supplemented or replaced by electrolysis, carbon dioxid snow and the Kromayer lamp, all of which give splendid results in selected cases.

4. *Keloid.*—This condition still continues to yield excellent results from radium treatment. Pain is usually relieved and the cosmetic results are good.

5. *Tuberculosis.*—In certain cases of lupus vulgaris the results from radium treatment are excellent, but on the whole are probably inferior to those obtained with the Finsen light.

Unfortunately there seems to be no selective action on lupus tissue, and the caustic effect of radium must be invoked to destroy the patch. In lupus of the mucous membranes radium is sometimes of great service. In tuberculosis verrucosa cutis the results from the destructive action of radium are usually excellent.

6. *Lupus Erythematosus.*—In this intractable disease radium is often of the greatest value. While relapses may occur, as might be expected, persistent treatment often results in a favorable outcome. In my experience radium is a most valuable adjunct to our armamentarium, and in some cases has succeeded when other measures have failed.

7. *Sycosis Vulgaris.*—I now treat long standing cases of sycosis vulgaris which have resisted other measures by removing the hair with radium. Any slight atrophy of the skin that may be produced is greatly preferred by most patients to the unsightly appearance caused by the sycosis which usually renders it impossible for them to follow their occupations. In careful hands this method of treatment may be recommended.

8. *Lichenification of the Skin.* — This obstinate condition usually yields to radium. Treatment consisting of several ten minute exposures with unscreened quarter strength applicators is frequently successful in relieving itching, and is often followed by the disappearance of the lesions.

9. *Pruritus.*—Localized pruritus (pruritus ani, etc.) is often relieved by radium. Radium treatment is especially indicated in cases of pruritus ani in which no local lesion can be found to account for the pruritus. If situated externally, unscreened varnish apparatus may be used, and exposures of from five to ten minutes, repeated several times, are often successful.

When within the anal opening I usually employ tubes of from 25 to 50 mg. element, screened with 0.5 mm. of silver, and give three or four exposures of from fifteen to twenty minutes' duration. This course of exposures may be repeated in a few weeks. Usually great relief, and sometimes recovery is experienced after one or two such courses of treatment.

In addition to the conditions referred to above, a number of other diseases of the skin are greatly benefited and sometimes completely relieved by radium; but these will be commented on at some future time.

RADIUM IN GYNECOLOGY*

By Henry Schmitz, M. D., F. A. C. S., Chicago.

Radium may be applied to benign and malignant diseases of the female pelvic organs. The benign disorders are myomata uteri, the hemorrhagic metropathies and chronic endometritides and cervicitides, the malignant, the carcinomata, chorionepitheliomata and sarcomata. I shall discuss in the following chapter the underlying principles and indications of actinotherapy in each of the diseases enumerated.

Myomata Uteri.

The cardinal symptoms of the benign uterine connective-tissue tumors are hemorrhage, discharge and pain. The hemorrhage is due to the pathological changes in the uterus and the ovaries. The ovaries cause monthly uterine hemorrhages, *i. e.*, menorrhagias, if they increase the output or intensity of their hormone. Such hyperfunction is due to the pelvic congestion usually found associated with any mass or tumor within the true pelvis or results from the small cystic degeneration of the ovaries so often present with myomata uteri. The menorrhagia are of uterine origin if a chronic hypertrophic and hyperplastic endometritis has resulted from the pressure of an intramural or submucous fibroid. A subserous pedunculated myoma rarely causes menorrhagia. The chronic endometritis and a general pelvic congestion are also responsible for the profuse leucorrhea so often found in myomatous disease of the uterus. Another causative factor is sought to be the noncontractibility or loss of contractibility of the myometrium and an elastoid degeneration of the uterine blood-vessels. Pain is either due to pressure and limitation of space or it is dysmenorrheic. Pressure pain is characterized by a sense of weight and fullness in the pelvis and often accompanied by mechanical obstruction of either the rectum or the urinary organs. The dysmenorrhea is either ovarian, when due to the small cystic degeneration of the ovaries, or uterine when caused by the menorrhagia and formation coagulae, the expulsion of which is frequently associated with intermittent and bearing down pains.

The three cardinal symptoms, hemorrhage, discharge and pain increase suddenly and alarmingly if a degeneration of a myoma occurs. It does not matter whether the degeneration is malignant or benign. With the aggravation in symptoms, also occurs a rapid growth of the tumor or tumors.

These clinical observations assist us in determining the mode of action a remedy should possess for a successful treatment of this condition. A fibroid not causing any symptoms does not need any medical interference, a bleeding fibroid demands arrest of hemorrhages and a tumor, causing pressure pains, or undergoing degeneration, surgical removal.

It is obvious that if menstruation would cease, the intensity of the hemorrhage would decrease, or the bleeding entirely subside. Radium acts as Nature's curette and hemostatic when applied to the endometrium. The destruction of endometrium by radium rays may be partial or total, depending on the mode of application and on the age and sextual status or vigor of the patient. If the endometrium is totally

*Interstate Medical Journal, XXIII, 1097-1104. December, 1916.

destroyed, amenorrhea results, if only partially, an oligomenorrhea. In other words, the application of radium in the young to destroy endometrium requires large massive doses from 2,000 to 3,000 mgrm. hours of gamma rays. The same result may be obtained in a woman's approaching the menopause, or who is thirty-five years or over in age with only a third or fourth amount of milligram hours. The latter applied in the young and sexually vigorous person would only result in a decrease, *i. e.*, the re-establishment of a normal menstruation or at most an oligomenorrhea. Total destruction of the endometrium leads to a cessation of the leucorrhea, while partial ablation of endometrial tissue results in a decrease in the amount of mucous secretion. In other words, it is entirely within our means to destroy the endometrium either partially or totally and thereby ameliorate the uterine hemorrhages or cause a cessation of menstrual life, *i. e.*, a premature climacteric.

A myomatous tumor causing pressure pain or undergoing degeneration must be removed surgically. It would be criminal to procrastinate affairs by an attempt at radiation which under such circumstances cannot benefit the patient or influence the tumor. Should a patient with myomatous tumors, however, have general contraindications to surgical interference, as a brown degeneration of the myocardium, chronic Bright's disease, diabetes, tuberculosis and so forth, then the application of radium would be indicated.

Whether the tumor subsides in the course of time is an open question. I have observed many patients in whom the tumor gradually disappeared within six to nine months. A thorough curettage of the endometrium must precede the application of radium under all conditions, to exclude the possibility of overlooking a coexisting carcinoma.

The objection to radiotherapy of bleeding myomata raised by surgeons (Deaver,[4] Tracy[5]) on account of the frequency of occurence of degeneration is obviously untenable. The purpose of medical and surgical treatment is to save life and prevent chronic invalidism. It is wrong to argue that if such and such disease might occur at some future time or such and such a degeneration occur in a benign condition, we would forstall the forces of the causation of disease or degeneration by the removal of such organs or localities. Indeed, the human body would be unrecognizable after a surgeon would have applied such principles to a submissive clientele.

The indications for the treatment of myomata uteri are: Myomata of the cervical, submucous and pedunculated varieties, degenerating fibroids, and tumors causing pressure must be removed surgically. Women below thirty-five years of age, desiring offspring, are myomectomized. All other myomata causing symptoms are subjected to radium treatment, which invariably causes a cure, primary as well as remote.

Hemorrhagic Metropathies.

Essential uterine hemorrhages result from functional derangements of the menstrual apparatus. These are disturbances in the interrelation of the ductless or endocrinal glands. Predisposing factors are chronic hypertrophy of the endo- or myometrium, hyaline degeneration of the tunica media of the uterine blood vessels, whereby their contractibility is lost, chronic congestion or stasis of the pelvic organs and so forth. The hyaline degeneration is a remnant of a rather imperfect involution following the termination of gestation. Chronic stasis of the pelvic organs results from occupations that require continuous sitting postures, obstinate and long-continued constipation, sexual perversions and so forth.

Disturbances of the internal secretion of the ovaries, *i. e.*, ovarian disfunction, either hyper- or hypofunctional, are frequent at the beginning and termination of the menstrual life. They need not worry us if occurring at the time of puberty. The institution of correct hygienic and therapeutic measures will soon ameliorate the disturbances and finally lead to normal menses. Hemorrhages appearing near or at the termination of menstrual life require an entirely different interpretation. The climacteric uterine hemorrhages, in fact all uterine hemorrhages, occurring during the childbearing, climacteric and senile periods of women, must be regarded as due to malignant disease unless otherwise proved. The only positive means for a correct diagnosis, if the clinical picture is not clear, is offered by the microscope. Hence it is criminal to treat a woman suffering from a uterine hemorrhage without first making a positive diagnosis. If the microscopic examination of endometrium and cervical tissue excludes malignancy and a careful bimanual examination does not reveal another pathology in the pelvis, and a scrupulously detailed general examination of the patient excludes an extragenital disease that might cause uterine hemorrhages, then the diagnosis of an essential, primary functional uterine hemorrhage is clear. If a hemorrhagic metropathy does not readily yield to the usual treatment, medicinal and mechanical or internal and local, then the application of radium is indicated, which invariably effects a cure. The modus operandi has been discussed in the preceding paragraph.

Chronic Endometritis and Cervicitis.

The specific symptom of these inflammations is a leucorrhea. Menorrhagias, dysmenorrhea and burning aches or pains in the deep of the pelvis may or may not be present. The leucorrhea is usually an expression of the hyperplasia and hypertrophy of the mucous glands and proliferation of the surface epithelium of the endometrium and endocervicum. These are caused either by infections or chronic stasis. The diagnosis of such a condition might be difficult or incorrect unless the diagnostic abrasio is performed during the period of the post-menstrual reconstruction of the endometrium. The hyperplastic endometritis is said to be of an infectious origin if plasma cells are found on examination of properly stained microscopic sections.

The customary treatment in the absence of adnexal disease is a curettage, followed by the application of caustics, such as iodine, iron-chloride, silver nitrate, carbolic acid, zinc chloride, formalin, a Beck's paste tampon, atmocausis and zestmocausis. The patient, following this treatment, seems to be entirely relieved of the leucorrhea. A recurrence soon occurs and within four to six months the patient is as bad as ever, and usually drifts into the hands of another practitioner who may repeat the same maneuvers or advise removal of the uterus.

Chronic endometritis and cervicitis which prove refractory towards the usual treatment should be subjected to applications of radium. Its action may be controlled thus curing leucorrhea and preserving the menstrual function and often also potency. The action of the remedy is readily understood by referring to its action under myomata uteri.

Carcinoma Uteri.

The success of the treatment of all malignant diseases of the uterus wholly depends on its early recognition, because the disease, in the beginning, is localized or strictly confined within the organ. The treatment must be surgical. Any other form of treatment would be

out of question, unless surgery is contraindicated on account of some physical or constitutional defect of the patient. This principle applies to carcinoma, chorion-epithelioma and sarcoma of the uterus.

Early recognition of malignancy of the genital organs is possible only if the patient is able to interpret intelligently her symptoms. This she may do if physicians will undertake to instruct their patients about the importance and significance of uterine hemorrhages, discharges, pain, loss of weight and strength, and point to the necessity of an immediate, complete and careful physical examination. The medical men, on the other hand, should endeavor to make the most careful and painstaking examination when the patient applies to him on account of the symptoms enumerated and render an efficient and correct diagnosis. The poor results obtained in the treatment of malignant disease in any part of the human body are due to the indolence of the public and the neglect and the indifference of the physician. Publicity in journals and newspapers would tend to correct this unfortunate state of affairs concerning the cancer question.

A localized malignant disease of the uterus demands an extended abdominal panhysterectomy preceded by a vaginal cauterization of the uterus. No other treatment will assure the same success to physician and patient. Should the disease have invaded neighboring organs and tissues as the para- and perimetrii, the bladder and rectum, ureter and bowels and so forth, it must be determined whether the cancer may still be eradicated by an operation. If operable, the same procedure must be applied as for the localized cancer. Results, of course, are very poor.

Inoperable cancers are hopeless and incurable, yet proper palliative measures may be used which will apparently restore the patient's state of health to normal and often also cause a local healing of the affected organs. It is only a question of time, when a recurrence or relapse takes place. The patient may again respond to palliative measures and obtain another respite from her eventual fate. Finally, death will relieve the doomed sufferer from her pitiful existence.

Palliative measures are varied, both as to kind and effect. Such remedies are excochleation, cauterization as Percy's method, the application of 50 per cent. alcoholic solutions of zinc chloride, Gellhorn's acetone treatment, the massive roentgen rays as advocated by Bumm,[3] and finally the gamma rays of radium and mesothorium. Having used all these measures carefully, patiently and extensively, I unhesitatingly state that radium is the best palliative remedial agent in this dreaded disease. It cannot be called curative until observations have extended over a space of time of five years. Radium restores the patient to a normal subjective condition and brings about a local healing of the organs in the majority of cases. Recurrences, however, take place within six, twelve, twenty-four or thirty-six months and the patient succumbs to a general carcinomatosis. The patient, in the meantime, leads a useful life, regains her working ability and earning capacity. Should a recurrence take place, they seem to lose strength rapidly, apparently suffer little and seem to succumb in a short time. It is worth the effort to use the remedy.

I have demonstrated by an extensive microscopic examination of uteri treated with gamma rays of radium, that the rays destroy cancer or stimulate embryonic cells to develop to adult, highly differentiated cells. Bumm has proved that the extent of the action of the gamma ray

radially is 2 to 4 cm. into the tissues. I have shown from experiments carried on in living tumor tissue that the gamma rays of 50 mgrm. radium element applied to an area of 2 square inches will destroy carcinoma within a depth of 1 cm. within twelve hours, within a depth of 2 cm. within forty-eight hours, and within a depth of 3 cm. within one hundred and eight hours. Why do patients treated according to these laws have recurrences or are not permanently cured? Evidently the carcinoma extended so far that the rays could not possibly destroy the growth in its entire extent. One might say that a longer continued application, or the use of larger amounts of radium, or the use of artificial canals dug into the tumor mass to admit the radium carrier, might have brought about a cure. The gamma rays of 50 mgrm. of radium element will cause a burn of first degree of the superficial layers of the skin or mucosa after an exposure of six hours, a second degree burn after an eight-hour exposure, and a third degree burn and sloughing of tissue after a twelve-hour exposure. The extent of the latter burn depends entirely upon the duration of the exposures. The longer the application of the rays to the tissues is, the deeper will be the destruction of the tissue. These facts place an absolute and definite limit on the time exposure and amount of radium that we might safely use. The knife is limited in its usefulness and the gamma rays likewise, although the extent of the action of the latter surpasses that of the former. The conclusion must be drawn that the earlier a case comes for treatment the better the results will be. Whether radium can cure cancer will be demonstrated within another year or two, when clinical observations will have passed the critical time period of five years.

Another usefulness for the gamma rays of radium consists in the possibility of its use after radical extirpation to prevent recurrences. Nests of carcinoma cells may have soiled the field of operation, and by inoculation result in a new growth. Or the apices of the cones or roots of cancer cells may have been left behind. The application of radium to the wound surface after a hysterectomy would effectually kill such parasites.

The recurrences after radium treatment usually take place in the base of the parametrii and in the glands along the hypogastric and iliac blood-vessels. They may be readily palpated through the rectum. I have repeatedly treated such recurrences, per rectum, by the combined method, *i. e.*, radium per rectum and massive x-rays through the anterior abdominal wall. A temporary improvement results. However, the rectum is so sensitive to the rays that effectual radiations are out of the question. This coincides with the results which we obtain in the ray treatment of rectal cancers. Prolonged and massive rayings per rectum cannot be borne by the patient. They cause unbearable and obstinate tenesmus, mucous-like diarrheal stools, and profuse serous discharges which may last from six to eight weeks in spite of every medical attention.

Radium therapy has not as yet been completely developed. It will require years and years of careful observation and close study by the clinician and physicist to perfect the therapy. The application of the radium is an art. It can only be acquired by the most painstaking observation and close application. In the hands of the uninitiated, radium is directly dangerous. The pioneers of the roentgen ray workers lost their lives or were crippled on account of the fact that its dangers

were not known. Many a patient succumbed to roentgen ray cancer because the therapeutist did not know the perfect technique as used at present. So it is with radium. The rays are wonderfully controllable if one only knows how to use them. They are terribly destructive, if not held within bounds.

At present we may claim that the radium rays will cause 100 per cent. cures, immediate and remote, in myomata uteri, hemorrhagic metropathies and chronic endometritides and cervicitides, if the indications as given above are scrupulously followed. In carcinoma uteri the use of radium is indicated as a prophylactic after radical extirpation when it will increase the efficacy of the surgical procedure. It is indicated in operable carcinomata if constitutional contraindications to surgery exist. It is a specific as a palliative in inoperable cancers, when it will cause an apparent cure in 35 per cent. of the cases and a subjective improvement in an additional 16 per cent.

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GLAZED FLAT RADIUM APPLICATORS

CHARLES H. VIOL, PH. D.

Homogeneous irradiation is an important prerequisite in the production of successful results in the local application of radium. Homogeneous irradiation can be attained in several ways, when radium is employed, viz:

I. Cross fire, where the effect of distance from the radium is overcome by placing several radium preparations at opposite sides of the growth which is being rayed.

II. Distance filtration, where the radium is moved far enough away from the growth so that the various parts of the growth receive about the same intensity of raying.

III. Use of a number of needles or tubes inserted within the growth, the multiple cross fire producing a fairly homogeneous raying.

IV. Use of flat radium applicators in which the radium is spread uniformly over an area.

The first three methods are more particularly suitable in the treatment of malignancy where a growth of some size is being rayed using the penetrating (gamma) rays. In the treatment of many dermatological conditions it is desirable to use the primary beta rays from radium, and where the condition covers considerable area, this is best accomplished by the use of a flat radium applicator. Up to the present these

flat applicators have been constructed by mixing the radium salt in a suitable varnish, which was spread on a metal support and allowed to harden. Varnishes being organic material do not stand up well under the effect of the rays. The result is that varnish applicators have a very limited life, those containing a larger proportion of radium per unit area breaking down soonest. The practice of the French and of the London Radium Institute has been to use the equivalent of 10 milligrams of crystalline radium bromide (5.3 mgm. of radium element) per square centimeter in the "full strength" applicators, "half" and "quarter strength" apparatus containing one-half and one-quarter this amount per square centimeter, respectively. According to the report of the London Radium Institute, such full strength applicators require remaking after several years, so that a high concentration of radium is not feasible owing to the very short life of the applicator. Our observations of various French varnish applicators, and our experience with a large number of varnish applicators, confirms the belief that such varnish apparatus is all comparatively short lived. The loss of radium is possible by chipping or cracking out of the varnish. This cracking is often hastened by the screwing in of a handle on the back of the plaque—or as a result of dropping the plaque on hard surfaces, or improper treatment in sterilization. In use the plaques should always be covered with a thin sheet of rubber tissue, to prevent soiling. Sterilization is accomplished in different ways, which depend upon the varnish used in making the applicator. The varnish which we have used in the past could be cleaned and sterilized by immersion in phenol, 95 per cent. alcohol or formaldehyde, etc., and the varnish is not affected by heat up to 110° C., or by steam. The cracking of the varnish has in general been the cause requiring the remaking of the applicator.

While fused silica is affected by the action of radium rays, which produce a cracking in the silica, possibly due to a devitrification, no such effect has been observed in the case of the glass tubes used to hold radium salts. For this reason it seemed possible that a glass or glaze containing the radium should be much more durable than the ordinary varnish mixture, and results of a series of experiments carried out in the Radium Research Laboratory of the Standard Chemical Company by the writer have shown that such is indeed the case. The new glazed radium applicators* are prepared using a lead free glass, such as has been used for years in the preparation of tubes of radium salt. Being lead free, the density of the glaze is low, and the absorption of the softer rays is not much greater than in the varnish applicators. This absorbtion of beta rays is reduced to a minimum by the use of as little glaze as possible, since it was found that some of the first glazed applicators prepared were not altogether satisfactory because of the absorption of too great a proportion of beta rays. Owing to the high melting point of this glass, silver has been selected as the best metal for the backs, and the applicators are supplied without the usual handle, in the form of flat, square or circular discs, containing the radium salt uniformly spread over the glazed area, the glaze being fused in a slight depression in the metal disc. Slight cracking in the glaze sometimes results but experience has shown that this is not serious, placques in this condition having been suspended in boiling water, and then dropped into ice water, repeatedly, without loss of radium, and even rough mechani-

*U. S. Patent No. 1,210,731, Jan. 2, 1917.

cal treatment such as repeated dropping the plaque from a height of three or four feet to a hard floor has not caused the glaze to chip out.

The limitation as regards amount of radium salt per unit area is not as great for the glazed apparatus as for the varnish. Thus far we have prepared a number of plaques containing 25 mgm. of radium element in an area of 2 square centimeters, which on the London Radium Institute basis is two and one-third times full strength. These applicators have been found quite satisfactory in service, and are of a "strength" that would be very difficult to prepare using varnish; and if prepared with varnish would have a brief life of usefulness before requiring remaking. The life of the glazed applicators should be much longer than that of the varnish applicators of corresponding strength, since the glass does not deteriorate in the way that varnish does, and the greater mechanical strength of the glazed applicators should make them withstand rough handling far better than the varnish apparatus.

REVIEWS AND ABSTRACTS.

Gordon B. New, M. D. (Mayo Clinic, Rochester, Minn.) Radium in the Treatment of Lymphangioma of the Tongue. Journal-Lancet, Dec. 1916; The Radium Quarterly, Jan. 1917. "The treatment of lymphangioma of the tongue, until recently, has been considered surgical, although the results obtained have not been very encouraging on account of the frequency of the recurrences of the condition and also the difficulties in trying to make a useful organ out of a large, thickened, and more than useless tongue. Surgical measures have usually consisted in excising as much of the tumor mass as possible, and then, by cutting out wedge-shaped pieces of tissue from about the margin of the tongue, attempting to construct a useful organ."

"Abbe reports three cases of lymphangioma of the tongue successfully treated by radium, and states that this type of tumor is one more condition which can be added to the list of those in which radium has a specific action. He states that the effect of radium in lymphangiomas is not destructive, but is an alterative action similar to its effect on papilloma or basal-cell epithelioma. He conjectures that the specific action of radium on lymphangioma is a charging up of the disordered cells of the tumor with negative electric particles, which when shot into the cells in proper quantity, completely change their habit of growth and permanently restore them to a perfectly healthy condition. The tumor gradually shrinks and disappears, and the tongue takes on its normal appearance and outline."

"I report here two cases of lymphangioma of the tongue treated by radium at the Mayo Clinic:

"Case 144,540—A. J., a girl, aged 12 years. The patient came to the Clinic October 29, 1915. She complained of the size of her tongue, which caused difficulty in eating and talking. Her father stated that she had been unable to put her tongue back in her month for four years. Eight years ago the parents noticed that her tongue was larger than normal, and since that time it had been increasing in size. For the last two months the increase in size had been more marked. During the last six weeks the patient had had seventeen X-ray treatments with no improvement. Her lower central incisor teeth had been removed six months previously, as they were loosened by the tongue. Examination showed the condition of her tongue to be a typical lymphangioma.

The patient was a pitiable sight. Her tongue was dry and cracked, and she was unable to draw it back into the mouth. It was impossible to understand what she said. She was treated with radium for two hours daily with a 22 mg. tube and no screening for a period of twelve days. She returned to the Clinic two months after this treatment showing a remarkable improvement. Her tongue fell back into her mouth readily, but was still slightly thickened. She has received further radium treatment, and the parents say she continues to improve."

"Case 151,037—K. C., a boy, aged 2 1-2 years. When the child was one year old his mother noticed a thickening near the center of the dorsum of the tongue about the size of a pea. This condition spread over the entire left side of the tongue. The child had been examined several times by physicians, but nothing was done in the way of treatment. The left half of the tongue was much thickened, and the surface showed pearly papules and other areas that resembled angioma. The condition was lymphangioma. The left side of the tongue was treated two hours daily with a 28 mg. tube of radium, unscreened, for a period of ten days. Soon after the treatment was begun a marked improvement was noticed. Two and one-half months after treatment when the patient returned to the Clinic the large tumor on the left side of the tongue had entirely disappeared and the tongue felt and appeared normal. These cases were treated by superficial application, but incising the tumor and placing the radium in the center of it gives good results in similar tumors."

"It would seem that radium is a specific for angioma and lymphangioma, and its great value is, that it gives such remarkable results in these conditions, which are not surgical. However, much is to be learned as to dosage and methods of applying the radium."

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Thomas R. Brown, M. D. (Baltimore). A Clinical Study of the Secretions of the Digestive Tract. The Boston Medical and Surgical Journal, CLXXV, No. 22, pp. 775-84, Nov. 30, 1916. "The Effect of Radium upon the Digestive Ferments. In our first series of experiments we used radio-active substances from various sources, such as radium lead and radio-active ores, while in our second series, carried on several years later with our assistant, Dr. Hendry, we used extremely radio-active water artificially prepared and kindly furnished us by Dr. Burnam from Dr. Kelly's supply. In our first series of experiments the influence of the radio-active substances was extremely slight and our conclusions were that none of the radium preparations seemed to have any effect upon the autolytic ferment of the liver, although this ferment was activated by lead chloride solution, with diastase the very radio-active D, E, F, possessed an inhibiting effect, while the radium D from emanation had a slight stimulating effect, increasing with the length of time and the amount of fluid used, this ferment being also markedly activated by various salts; with pepsin we found a slight inhibiting effect more marked with the very radio-active D, E, F, although slight in comparison with the inhibiting effect of saturated lead chloride solution."

"In our second series of experiments on pepsin, trypsin, lipase and diastase the only effect noted was a very slight inhibition in a very few cases, in the majority of cases no effect whatsoever; our findings thus agreeing with the more recent work of Gudzent and Stoklasa, and in direct disagreement with the earlier work of Bickel, Bergel, Wohlgemuth."

STANDARD CHEMICAL COMPANY

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RADIUM CHEMICAL COMPANY,

Forbes and Meyran Avenues,

Pittsburgh, Pa., U. S. A.